DOE/NE-ID-11139
Revision 0
January 2005

Track 1 Decision Documentation Package for TRA-605 Warm Waste Line

DOE/NE-ID-11139
Revision 0
Project No. 23368

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January 2005

Prepared for the
U.S. Department of Energy
Idaho Operations Office

DECISION DOCUMENTATION PACKAGE
COVER SHEET

Prepared in accordance with

TRACK 1 SITES:
GUIDANCE FOR ASSESSING
LOW PROBABILITY HAZARD SITES
AT THE INEEL

Site Description: **TRA-605 Warm Waste Line**

Site ID: **TRA-63** **Operable Unit:** **10-08**

Waste Area Group: **10**

I. SUMMARY – Physical Description of the Site:

In October 2001, during excavation of soil for the 30-in. Test Reactor Area (TRA)-605 Warm Waste Pipeline Replacement Project at the Idaho National Engineering and Environmental Laboratory (INEEL), a break in the 4-in. Duriron warm waste pipeline (WDC-605) was discovered at a depth of approximately 72 in. below ground surface (bgs) (see Appendix A). This break was an approximate 1/2-in. offset shear in the 4-in. pipeline, and water was seen seeping from it. The edges of the sheared pipe were corroded, indicating that the break may have existed for some time.[1] As soil was removed from around the pipe, a puddle of approximately 3 gal of radioactively contaminated water formed in the hole around the pipe. The soil was surveyed using a hand-held frisker, confirming the presence of 300,000 disintegrations per minute (dpm) of contamination in the removed soil.[1]

The source water to the 4-in. warm waste pipeline was stopped by turning off the pumps to the effluent radiation monitor system in the TRA-605 Process Water Building. Seepage from the pipe then stopped.[1] A "Stop-It" patch, which is a water-activated polyurethane resin on fiberglass (GFE pipe wrap repair system) by InduMar Products, Inc., was installed over the break in the 4-in. warm waste pipeline on October 18, 2001. The 4-in. pipeline was used until it was isolated on both the upstream and downstream ends in May 2002.[2,3] The 4-in. pipeline was replaced with a new 4-in. pipeline in May 2002[2] (see Appendix A).

Fifteen 55-gal drums (numbered TRA020017 through TRA020024, TRA020026 through TRA020029, and TRA020078 through TRA020080) of radiologically contaminated soil were removed from the area immediately adjacent to the 4-in. warm waste pipeline and transferred to the Radioactive Waste Management Complex (RWMC) on November 25, 2002.[2]

According to John McQuary, former TRA Project Manager for the 30-in. TRA-605 Warm Waste Pipeline Replacement Project, soil was excavated under and around the 4-in. pipeline only to repair the break, and not all of the contaminated soil was removed from the site. Based on information in Appendix B, it is likely that approximately 4.66E+06 ft^3 of contaminated soil is still present adjacent to the 4-in. warm waste pipeline (see questions 7 and 8). After completion of the 30-in. TRA-605 Warm Waste Pipeline Replacement Project, the area was backfilled with clean fill material.

The 4-in. Duriron warm waste pipeline (WDC-605) and the surrounding soil are designated as Site TRA-63.

DECISION RECOMMENDATION

II. SUMMARY - Qualitative Assessment of Risk:

The level of reliability for the information collected is moderately reliable with a high qualitative assessment of risk. An undetermined quantity of radiologically contaminated soil is present at the site. The data were collected and confirmed following documented procedures, and no conflicting information is apparent. Therefore, when this information is plotted on the Qualitative Risk and Reliability Evaluation Table, an intersection in the "interim action" portion of the chart is reached.

III. SUMMARY - Consequences of Error:

False negative error:

The false negative decision error would be to conclude that radiologically contaminated soil remaining at TRA-63 poses no unacceptable risk to human health and/or the environment when the soil does pose a risk. This decision would result in no further action being taken at the site when further action is warranted. The consequences of this would be fewer controls in place to ensure protection to human health and the environment for the chosen remedial alternative (i.e., no further action) when, in fact, these controls should be in place. In addition, if no further action is taken, there may be the potential for migration to the groundwater pathway, resulting in a higher risk than anticipated.

False positive error:

The false positive error would be to conclude that radiologically contaminated soil remaining at TRA-63 poses an unacceptable risk to human health and/or the environment when the soil poses no risk. This decision would result in an inappropriate selection of remedial alternatives (i.e., taking action when none is necessary). If action were taken at a low-risk site, this would result in the unnecessary expenditure of resources that could be used at higher-risk sites.

IV. SUMMARY - Other Decision Drivers:

Some risk may exist from leaving the contaminated soil and the pipeline in the ground, but the risk of exposure potential would be increased if the contaminated soil and the pipeline were excavated and removed now. Consequently, the risk would be greater by excavating and removing the contaminated soil and pipeline due to the surrounding facilities, utilities, and other buried lines in the vicinity compared to leaving the pipeline in the ground until the entire area can be deactivated.

Recommended Action:

Based on previous sampling data and known releases at this site, collection of additional samples is recommended during a Track 2 study for Site TRA-63. The analytical data for the soil contamination are incomplete. The extent and quantification of the contamination are also incomplete. The Track 2 study should completely delineate the three-dimensional footprint of the TRA-63 site, and a risk assessment of the delineated site should be conducted.

Signatures:	**# Pages: 137**	**Date:**
Prepared By: Kathy Jensen		**DOE WAG Manager:**
Approved By:		**Independent Review:**

DECISION STATEMENT
(DOE RPM)

Date Received: 1/31/05

Disposition:

TRA-605 Warm Waste Line will be characterized more fully. That information will be used in following the New Site Flow Chart agreed to in January 2005. The final disposition of this site will be documented in OU 10-08. At this time, preliminary data indicate that Institutional Control will be needed.

Date: 1/31/05	# Pages (decision statement): 1
Name: Kathleen E Hain	Signature: Kathleen E Hain

DECISION STATEMENT
(EPA RPM) site - TRA-63

Date Received:

Disposition:

EPA agrees this site should proceed to a track 2 investigation

Date: 9-23-04	# Pages (decision statement):
Name: DENNIS Faulk	Signature:

DECISION STATEMENT
(by STATE RPM)

Date recd: March 18, 2004

Disposition:

TRA-63

This site was discovered during the TRA-605 Warm Waste Pipeline Project in October 2001. Soil at a depth of about 60 inches was found to exhibit 30,000 disintegrations per minute (dpm) and 300,000 dpm for soil from a depth of 72 inches.. A broken 4-inch diameter Duriron warm waste pipeline was found at a depth of about 72 inches. It is estimated that over 1.7 million gallons may have discharged through the break in this line before the discovery of the leak. The estimated volume of leak and concentrations of radionuclides in the wastewater have been used to estimate the level of contamination expected in the subsurface. Contaminated soil was removed to facilitate the repair but it is estimated that 4.6E+06 ft^3 of contaminated soil remains. It is estimated that 1.11E+15 pCi of Co-60 and 1.33E+14 pCi of Cs-137 maybe present as well as numerous other radionuclides.

This site warrants further investigation under the Track 2 process to further evaluate the release and potential risks to human health and the environment. DEQ recommends this site for a Track 2 investigation.

DATE: 5-26-04	# PAGES (decision statement):
NAME: Daryl Koch	SIGNATURE: Daryl F. Koch

DETERMINATION

The U.S Department of Energy, U.S Environmental Protection Agency Region 10, and Idaho Department of Environmental Quality have completed the review of the referenced information for site TRA-63 in Operable Unit 10-08 as it pertains to the INEEL Federal Facility Agreement and Consent Order of 1991. Based on this review, the Parties have determined that a Track 2 investigation should be initiated.

Brief summary of the basis for the action:

DOE, EPA, and DEQ provided concurrence on the signed decision statement pages and determined that signatures on this page were unnecessary.

References:

DOE Project Manager _____ _____
Date

EPA Project Manager _____ _____
Date

IDEQ Project Manager _____ _____
Date

PROCESS/WASTE WORKSHEET
ID: TRA-63

Col 1 Processes Associated With this Site	Col 2 Waste Description & Handling Procedures	Col 3 Description & Location of any Artifacts/Structures/Disposal Areas Associated with this Waste or Process
The historical process associated with the 4-in. Duriron-capped and abandoned pipeline is wastewater transport from the TRA-605 Process Water Building to the former 30-in. warm waste pipeline. The capped and abandoned 4-in. transfer line is still located beneath the ground surface.	The 4-in. Duriron-capped and abandoned pipeline currently contains an undetermined quantity of resin contaminated with pretreated wastewater. In addition, there is evidence that this 4-in. pipeline leaked. Contaminated soil and free liquid that resulted from a break in the 4-in. pipeline were identified south of TRA-605. The 4-in. pipeline transferred treated wastewater effluent, which initiated from either the TRA-605 or -670 warm waste treatment facilities, to the former 30-in. warm waste pipeline. The wastewater passed through mixed cation/anion resin beds within TRA-605 and –670; these beds removed radioactive constituents to meet regulatory limits and the waste acceptance criteria for the evaporation pond. The wastewater was then discharged to the 4-in. pipeline.	**Artifact:** 4-in. warm waste pipeline (WDC-605) **Location:** Extends 8 ft (to the south) from the east side of the TRA-605 Process Water Building and then extends 65 ft (to the east) to the 30-in. warm waste pipeline (WDB-605) **Description:** The 4-in. Duriron pipeline carried treated water effluent from the TRA-605 warm waste treatment facility to the 30-in. warm waste pipeline (WDB-605) from approximately 1984 to May 2002.

CONTAMINANT WORKSHEET

SITE ID: TRA-63

PROCESS: Pretreated water transport **WASTE: Soil contaminated with treated water effluent**

Col 4 What Known/Potential Hazardous Substance/Constituents Are Associated with this Waste or Process?	Col 5 Potential Sources Associated with this Hazardous Material	Col 6 Known/Estimated Concentration of Hazardous Substances/ Constituents[a]	Col 7 Risk-based Concentration (pCi/L)	Col 8 Qualitative Risk Assessment (hi/med/low)	Col 9 Overall Reliability (high/med/low)
H-3	Contaminated soil	Unknown	20,000	High	Medium
Na-24	Contaminated soil	0 Ci	600	Low	Medium
Cr-51	Contaminated soil	3.93E-07 Ci	6,000	High	Medium
Mn-54	Contaminated soil	1.550 Ci	300	High	Medium
Co-57	Contaminated soil	13 Ci	1,000	High	Medium
Co-58	Contaminated soil	3.15E-03 Ci	300	High	Medium
Co-60	Contaminated soil	841.4 Ci	100	High	Medium
Nb-95	Contaminated soil	4.17E-06 Ci	300	High	Medium
Zr-95	Contaminated soil	2.20E-03 Ci	200	High	Medium
Ce-141	Contaminated soil	2.23E-07 Ci	300	High	Medium
Ce-144	Contaminated soil	1.022 Ci	30	High	Medium
Cs-134	Contaminated soil	4.610 Ci	80	High	Medium
Cs-137	Contaminated soil	126.6 Ci	200	High	Medium
Eu-152	Contaminated soil	73.71 Ci	200	High	Medium
Eu-154	Contaminated soil	75.38 Ci	60	High	Medium
Eu-155	Contaminated soil	20.76 Ci	600	High	Medium
Gross alpha	Contaminated soil	1.190 Ci	15	High	Medium
Gross beta	Contaminated soil	443 Ci	50	High	Medium
Hf-181	Contaminated soil	6.46E-05 Ci	200	High	Medium
Fe-59	Contaminated soil	2.62E-05 Ci	200	High	Medium
Zn-65	Contaminated soil	4.480 Ci	300	High	Medium
Ru-103	Contaminated soil	9.87E-07 Ci	200	High	Medium
Ru/Rh-106	Contaminated soil	12.47 Ci	30	High	Medium
Ta-182	Contaminated soil	0.0370 Ci	100	High	Medium

a. Values have been decay corrected (see Appendix C).

CONTAMINANT WORKSHEET

SITE ID: TRA-63

PROCESS: Pretreated water transport

WASTE: Resin remaining in the 4-in. abandoned pipeline

Col 4 What Known/Potential Hazardous Substance/Constituents Are Associated with this Waste or Process?	Col 5 Potential Sources Associated with this Hazardous Material	Col 6 Known/Estimated Concentration of Hazardous Substances/ Constituents[a]	Col 7 Risk-based Concentration (pCi/L)	Col 8 Qualitative Risk Assessment (hi/med/low)	Col 9 Overall Reliability (high/med/low)
H-3	Resin remaining within the 4" pipeline	Unknown	20,000	High	Medium
Na-24	Resin remaining within the 4" pipeline	Unknown	600	High	Medium
Cr-51	Resin remaining within the 4" pipeline	5.15E-12 Ci	6,000	Low	Medium
Mn-54	Resin remaining within the 4" pipeline	3.23E-06 Ci	300	High	Medium
Co-57	Resin remaining within the 4" pipeline	1.10E-05 Ci	1,000	High	Medium
Co-58	Resin remaining within the 4" pipeline	1.20E-08 Ci	300	High	Medium
Co-60	Resin remaining within the 4" pipeline	1.59E-03 Ci	100	High	Medium
Nb-95	Resin remaining within the 4" pipeline	2.98E-11 Ci	300	Low	Medium
Zr-95	Resin remaining within the 4" pipeline	2.00E-08 Ci	200	High	Medium
Ce-141	Resin remaining within the 4" pipeline	1.88E-13 Ci	300	Low	Medium
Ce-144	Resin remaining within the 4" pipeline	5.84E-06 Ci	30	High	Medium
Cs-134	Resin remaining within the 4" pipeline	7.68E-06 Ci	80	High	Medium
Cs-137	Resin remaining within the 4" pipeline	1.29E-04 Ci	200	High	Medium
Eu-152	Resin remaining within the 4" pipeline	9.51E-05 Ci	200	High	Medium
Eu-154	Resin remaining within the 4" pipeline	7.90E-05 Ci	60	High	Medium
Eu-155	Resin remaining within the 4" pipeline	2.33E-05 Ci	600	High	Medium
Gross alpha	Resin remaining within the 4" pipeline	Unknown	15	High	Medium
Gross beta	Resin remaining within the 4" pipeline	Unknown	50	High	Medium
Hf-181	Resin remaining within the 4" pipeline	4.95E-10 Ci	200	High	Medium
Fe-59	Resin remaining within the 4" pipeline	2.20E-11 Ci	200	Low	Medium
Zn-65	Resin remaining within the 4" pipeline	8.31E-06 Ci	300	High	Medium
Ru-103	Resin remaining within the 4" pipeline	1.21E-11 Ci	200	Low	Medium
Ru/Rh-106	Resin remaining within the 4" pipeline	1.05E-05 Ci	30	High	Medium
Ta-182	Resin remaining within the 4" pipeline	1.42E-07 Ci	100	High	Medium

a. Values have been decay corrected (see Appendix C).

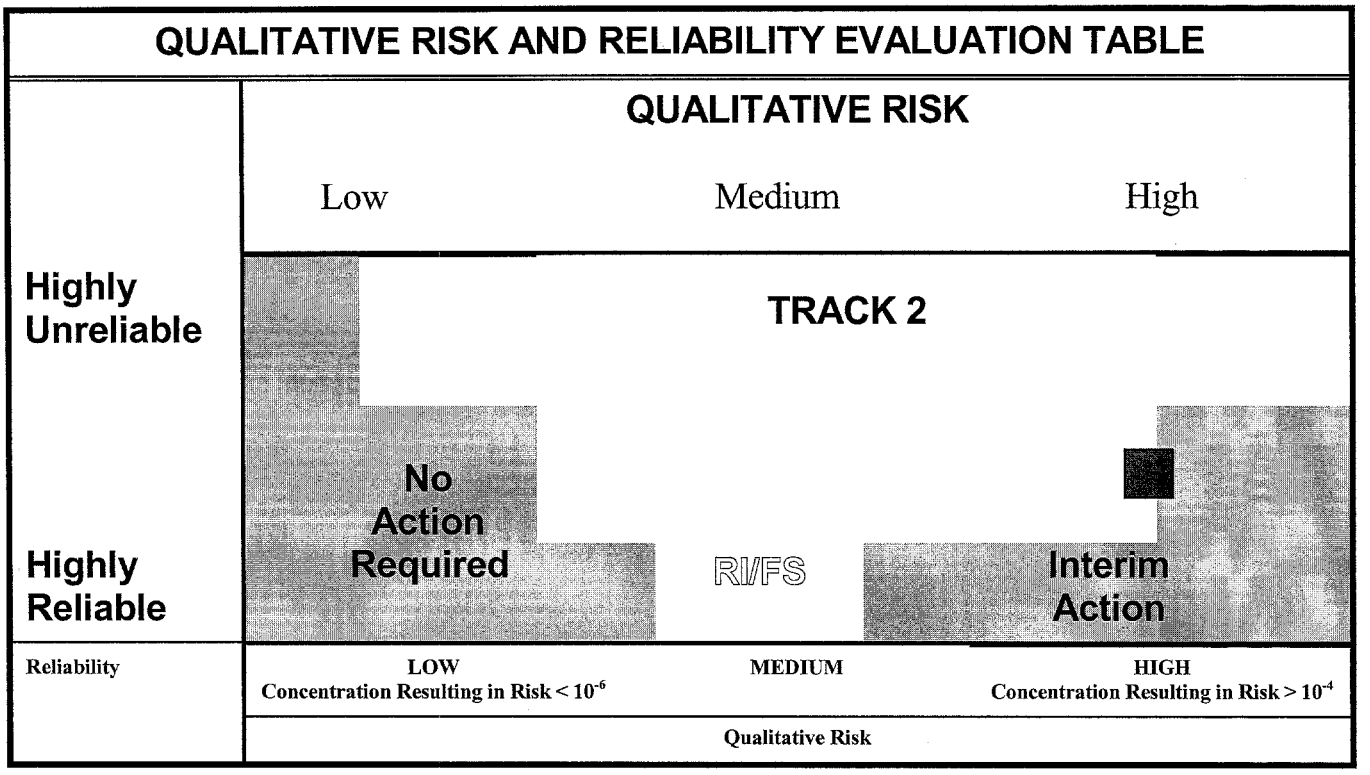
CONTAMINANT WORKSHEET

SITE ID: TRA-63

PROCESS: Pretreated water transport **WASTE: Treated water effluent leaking from the 4-in. pipeline**

Col 4 What Known/Potential Hazardous Substance/Constituents Are Associated with this Waste or Process?	Col 5 Potential Sources Associated with this Hazardous Material	Col 6 Known/Estimated Concentration of Hazardous Substances/ Constituents[a]	Col 7 Risk-based Concentration (pCi/L)	Col 8 Qualitative Risk Assessment (hi/med/low)	Col 9 Overall Reliability (high/med/low)
H-3	Treated water effluent	54.92 Ci	20,000	High	Medium
Na-24	Treated water effluent	0 Ci	600	Low	Medium
Cr-51	Treated water effluent	1.0E-09 Ci	6,000	Low	Medium
Mn-54	Treated water effluent	1.18E-03 Ci	300	High	Medium
Co-60	Treated water effluent	0.9599 Ci	100	High	Medium
Nb-95	Treated water effluent	1.20E-08 Ci	300	High	Medium
Zr-95	Treated water effluent	8.68E-06 Ci	200	High	Medium
Mo-99	Treated water effluent	2.44E-88 Ci	600	Low	Medium
Sb-124	Treated water effluent	5.26E-07 Ci	300	High	Medium
Cs-137	Treated water effluent	0.0647 Ci	200	High	Medium
Eu-152	Treated water effluent	0.1720 Ci	200	High	Medium
Eu-154	Treated water effluent	0.1620 Ci	60	High	Medium
Eu-155	Treated water effluent	0.0528 Ci	600	High	Medium
Gross Alpha	Treated water effluent	1.40E-07 Ci	15	High	Medium
Gross Beta	Treated water effluent	1.85 Ci	50	High	Medium
Hf-181	Treated water effluent	0.046 Ci	200	High	Medium

a. Values have been decay corrected (see Appendix C).



■ Risk from 4-in. warm waste pipeline

Risk from the 4-in. warm waste pipeline (■) was based on the following:

- The initial recommended action is based on the overall reliability and risk-based concentrations given on the contaminant worksheets.
- This table is a tool, providing an initial recommended action.
- For most of the radionuclides, the qualitative risk assessment on the contaminant worksheets was determined to be high. However, some radionuclides had a low qualitative risk assessment.
- The available analytical data were determined to be accurate and reliable.
- The overall data were determined to be moderately reliable based on the limited quantity of analytical data available.

PROCESS: Contaminated Soil; Abandoned Pipeline

Question 1. What are the waste-generation process locations and dates of operation associated with this site?

Block 1 Answer:

No waste-generation processes are currently associated with this site. However, waste was generated in October 2001 due to a leak in the 4-in. Duriron warm waste pipeline. This pipeline was not part of a landfill or disposal facility.

The 4-in. Duriron warm waste pipeline was in service as a treated wastewater effluent line from approximately 1984 to May 2002. It extended approximately 8 ft to the south of the TRA-605 Process Water Building, turned east, and extended approximately 65 ft to the 30-in. warm waste pipeline.[4–8] The warm wastewater in the 4-in. pipeline was normally pretreated water; radioactive constituents were removed by passing through mixed cation/anion resin beds in either the TRA-605 or -670 warm waste treatment facilities to meet regulatory limits and the waste acceptance criteria of the evaporation pond. The wastewater was then circulated through a radiation monitor before discharging to the 4-in. warm waste pipeline.[9] Approximately 9,000 gal of warm wastewater flowed through the 4-in. pipeline to the 30-in. warm waste pipeline on a daily basis. No discrepancy was noted between the amount of Advanced Test Reactor (ATR) warm waste discharge volume and the volume of water being discharged to the warm waste evaporation pond.[9]

In October 1997, the area immediately south of the TRA-605 Process Water Building was excavated in order to perform nondestructive examination (NDE) of warm waste piping. NDE of the 30-in. warm waste pipeline, which had been in service for 30+ years, indicated general external surface corrosion and pitting (see Appendix A).[10] Based on the results of the NDE and the in-service time of 30 to 40 years, Engineering recommended replacement of the TRA warm waste system buried piping within the 5 years following April 1998. During the NDE, the 4-in. warm waste pipeline (WDC-605) was inspected, and no pipe breaks were evident.[1] In addition, no contamination was detected during this investigation.

On October 9, 2001, during excavation of soil for the 30-in. TRA-605 Warm Waste Pipeline Replacement Project, a radiological control technician performing direct scanning of removed soil detected contamination in a backhoe bucket load of removed soil. A survey of this soil with a hand-held frisker confirmed the presence of 30,000 dpm of contamination in the removed soil, but at that time, the source of the contamination could not be ascertained. The bucket of contaminated soil was obtained from a depth of approximately 5 ft bgs.[1,9]

Under carefully controlled conditions, excavation was continued to approximately 72 in. bgs, and on October 16, 2001, the 4-in. Duriron warm waste pipeline (WDC-605) was uncovered. Water was seen seeping from around the 4-in. pipeline. As soil was removed from around the pipe, a puddle of approximately 3 gal of radioactively contaminated water formed in the hole around the pipe. It became evident from an approximate 1/2-in. offset shear in the pipe that the 4-in. warm waste pipeline had broken. The edges of the sheared pipe were corroded, indicating that the break may have existed for some time (see Appendix A). The ratio of the surface area of the crack to the cross-sectional area of the pipe was approximately 0.13; approximately 13% of the discharge through the pipe could potentially have been lost through the crack. A survey of the soil was performed using a hand-held frisker and confirmed the presence of 300,000 dpm of contamination in the removed soil.[1]

Block 1 Answer (continued):

The source water to the 4-in. warm waste pipeline was stopped by turning off the pumps to the effluent radiation monitor system in TRA-605. Seepage from the pipe then stopped.[1] A bell hole was excavated to a depth of approximately 1 ft beneath the break in the 4-in. pipeline, and a "Stop-It" patch, which is a water-activated polyurethane resin on fiberglass (GFE pipe wrap repair system) made by InduMar Products, Inc., was installed over the break in the 4-in. warm waste pipeline. This patch was installed on October 18, 2001, to ensure that there would be no further leakage from the pipe.[1] The 4-in. pipeline was used until it was isolated on the upstream and downstream ends in May 2002.[2,3] The 4-in. pipeline was replaced with a new 4-in. pipeline in May 2002.[2]

It is not currently known how long the 4-in. warm waste pipeline leaked or how much leakage occurred from the pipe. According to John McQuary,[11] former TRA Project Manager for the 30-in. TRA-605 Warm Waste Pipeline Replacement Project, it is possible that the 4-in. pipeline was accidentally broken after NDE of warm waste piping when the area was backfilled and compacted with heavy equipment.

Block 2 How reliable are the information sources? ☒ High ☐ Med ☐ Low (check one)
Explain the reasoning behind this evaluation.

A TRA Historical Wastewater Release Summary identifies the timeframe in which the 4-in. pipeline was in use. While the summary is not a published document, a fact sheet,[9] dated October 10, 2001, confirms the data given in the summary. In addition, interviews with personnel intimately familiar with the 30-in. TRA-605 Warm Waste Pipeline Replacement Project[12] and an occurrence report confirmed the information in the summary and the fact sheet.

Block 3 Has this INFORMATION been confirmed? ☒ Yes ☐ No (check one)
If so, describe the confirmation.

Several sources confirm the information given regarding the 4-in. warm waste pipeline and the processes associated with this pipeline. Therefore, this information is considered highly reliable.

Block 4 Sources of Information [check appropriate box(es) & source number from reference list]

No available information	☐	**Analytical data**	☐
Anecdotal	☒ 2,11,13,14	**Documentation about data**	☐
Historical process data	☐	**Disposal data**	☐
Current process data	☐	**QA data**	☐
Areal Photographs	☐	**Safety analysis report**	☐
Engineering/site drawings	☒ 6,7,8	**D&D report**	☐
Unusual Occurrence Report	☒ 1	**Initial assessment**	☒ 15
Summary documents	☒ 3	**Well data**	☐
Facility SOPs	☐	**Construction data**	☐
OTHER	☒ 9		

PROCESS: Contaminated Soil; Abandoned Pipeline

Question 2. What are the disposal process locations and dates of operation associated with this site?

Block 1 Answer:

No disposal processes are currently associated with this site. However, waste was generated in October 2001 due to a leak in the 4-in. Duriron warm waste pipeline. Contaminated soil was disposed of in November 2001.

A total of fifteen 55-gal drums (numbered TRA020017 through TRA020024, TRA020026 through TRA020029, and TRA020078 through TRA020080) of radiologically contaminated soil were removed from the area immediately adjacent to the 4-in. warm waste pipeline and transferred to the RWMC on November 25, 2002.[2] According to John McQuary,[11] former TRA Project Manager for the 30-in. TRA-605 Warm Waste Pipeline Replacement Project, soil was excavated under and around the 4-in. pipeline only to repair the break, and not all of the contaminated soil was removed from the site. In addition, only a small portion of the 30-in. pipeline was exposed during the 30-in. TRA-605 Warm Waste Pipeline Replacement Project. Therefore, it is likely that contaminated soil is still present adjacent to the 4-in. warm waste pipeline and potentially beneath the 30-in. warm waste pipeline. After completion of the project, the area was backfilled with clean fill material.

Block 2 How reliable are the information sources? ☒ High ☐ Med ☐ Low (check one) Explain the reasoning behind this evaluation.

A TRA Historical Wastewater Release Summary identifies the timeframe in which the 4-in. pipeline was in use. While the summary is not a published document, a fact sheet,[9] dated October 10, 2001, confirms the data given in the summary. In addition, interviews with personnel intimately familiar with the 30-in. TRA-605 Warm Waste Pipeline Replacement Project[12] and an occurrence report confirmed the information in the summary and the fact sheet.

Block 3 Has this INFORMATION been confirmed? ☒ Yes ☐ No (check one) If so, describe the confirmation.

Several sources confirm the information given regarding the 4-in. warm waste pipeline and the processes associated with this pipeline. Therefore, this information is considered highly reliable.

Block 4 Sources of Information [check appropriate box(es) & source number from reference list]

No available information	☐	**Analytical data**	☐
Anecdotal	☒ 2,11,13,14	**Documentation about data**	☐
Historical process data	☐	**Disposal data**	☐
Current process data	☐	**QA data**	☐
Areal Photographs	☐	**Safety analysis report**	☐
Engineering/site drawings	☐	**D&D report**	☐
Unusual Occurrence Report	☒ 1	**Initial assessment**	☒ 15
Summary documents	☒ 3	**Well data**	☐
Facility SOPs	☐	**Construction data**	☐
OTHER	☒ 9		

PROCESS: Contaminated Soil; Abandoned Pipeline

Question 3. Is there empirical, circumstantial, or other evidence of migration? If so, what is it?

Block 1 Answer:

Yes, there is empirical, circumstantial, or other evidence of migration. On October 9, 2001, during excavation of soil for the 30-in. TRA-605 Warm Waste Pipeline Replacement Project, a radiological control technician detected contamination in a backhoe bucket load of removed soil. A survey of this soil with a hand-held frisker confirmed the presence of 30,000 dpm of contamination in the removed soil. Excavation continued to approximately 72 in. bgs. At this depth, the 4-in. warm waste pipeline (WDC-605) was uncovered, and water was observed seeping from around the 4-in. pipeline. As soil was removed from around the pipe, a puddle of approximately 3 gal of radioactively contaminated water formed in the hole around the pipe (see Appendix A). It became evident from an approximate ½-in. offset shear in the pipe that the 4-in. warm waste pipeline had broken. Further, the edges of the sheared pipe were corroded, indicating that the break may have existed for some time. The ratio of the surface area of the crack to the cross-sectional area of the pipe was approximately 0.13; approximately 13% of the discharge through the pipe could potentially have been lost through the crack. Approximately 9,000 gal of warm wastewater flowed through this line on a daily basis. A survey of the soil was performed using a hand-held frisker and confirmed the presence of 300,000 dpm of contamination in the removed soil.[1]

Block 2 How reliable are the information sources? ☐ High ☒ Med ☐ Low (check one)
Explain the reasoning behind this evaluation.

The New Site Identification (NSI) for TRA-63 was initiated based on the release of radiologically contaminated wastewater to the environment. In addition, interviews with personnel intimately familiar with the 30-in. TRA-605 Warm Waste Pipeline Replacement Project confirm that radiologically contaminated soil is present at TRA-63. Further, an occurrence report confirmed the information given in the NSI. However, no information is available that states when the 4-in. warm waste pipeline was broken or how much wastewater was released as a result of the break.

Block 3 Has this information been confirmed? ☒ Yes ☐ No (check one)
If so, describe the confirmation.

Several sources detail the release of warm wastewater from the 4-in. warm waste pipeline. Therefore, this information is considered highly reliable.

Block 4 Sources of Information [check appropriate box(es) & source number from reference list]

No available information	☐	**Analytical data**	☒ 4,5,16,17,18,19,20,21
Anecdotal	☒ 2,11,13,14	**Documentation about data**	☐
Historical process data	☐	**Disposal data**	☐
Current process data	☐	**QA data**	☐
Areal Photographs	☐	**Safety analysis report**	☐
Engineering/site drawings	☒ 6,7,8	**D&D report**	☐
Unusual Occurrence Report	☒ 1	**Initial assessment**	☒ 15
Summary documents	☒ 3	**Well data**	☐
Facility SOPs	☐	**Construction data**	☐
OTHER	☐		

PROCESS: Contaminated Soil; Abandoned Pipeline

Question 4. Is there evidence that a source exists at this site? If so, list the sources and describe the evidence.

Block 1 Answer:

Yes, there is evidence that a source exists at this site. The former 4-in. warm waste pipeline is still located beneath the ground surface at this site and contains an undetermined quantity of resin contaminated with warm waste. This pipeline constitutes the source.

However, the pipeline has not been used since May 2002. In addition, during the 30-in. TRA-605 Warm Waste Pipeline Replacement Project, the 4-in. pipeline was isolated on both the upstream and downstream ends. According to Dan Vetter,[14] no free liquid is contained within the 4-in. pipeline, so it is unlikely that the contents of the 4-in. pipeline could be released to the environment.

Block 2 How reliable are the information sources? ☒ High ☐ Med ☐ Low (check one) Explain the reasoning behind this evaluation.

The information regarding the source at TRA-63 is well documented and is considered highly reliable. An engineering drawing documents the presence and location of the 4-in. warm waste pipeline. The NSI describes the 4-in. pipeline and establishes that a release of warm wastewater occurred. In addition, the occurrence report confirms the information given in the NSI. Interviews with personnel intimately familiar with the 30-in. TRA-605 Warm Waste Pipeline Replacement Project confirm that the 4-in. pipeline is still located below the ground surface at TRA-63.

Block 3 Has this information been confirmed? ☒ Yes ☐ No (check one) If so, describe the confirmation.

Several sources give information regarding the 4-in. warm waste pipeline. In addition, the information regarding the source at TRA-63 is well documented and is therefore considered highly reliable.

Block 4 Sources of Information [check appropriate box(es) & source number from reference list]

No available information	☐	**Analytical data**	☐
Anecdotal	☒ 2,11,13,14	**Documentation about data**	☐
Historical process data	☐	**Disposal data**	☐
Current process data	☐	**QA data**	☐
Areal Photographs	☐	**Safety analysis report**	☐
Engineering/site drawings	☒ 6,7,8	**D&D report**	☐
Unusual Occurrence Report	☒ 1	**Initial assessment**	☒ 15
Summary documents	☐	**Well data**	☐
Facility SOPs	☐	**Construction data**	☐
OTHER	☐		

PROCESS: Contaminated Soil; Abandoned Pipeline

Question 5. Does site operating or disposal historical information allow estimation of the pattern of potential contamination? If the pattern is expected to be a scattering of hot spots, what is the expected minimum size of a significant hot spot?

Block 1 Answer:

Yes, the site operating or disposal historical information allows an estimation of the pattern of potential contamination. A limited number of samples has been collected, documenting that subsurface soil contamination is present at a depth of approximately 6 ft bgs adjacent to the 4-in. pipeline at TRA-63. However, sufficient samples have not been collected to delineate the three-dimensional footprint of the TRA-63 site.

Approximately 4 yd^3 of contaminated soil was excavated from around a leak in the 4-in. pipeline, containerized in 55-gal drums, and transported to the RWMC. There is a potential that the 4-in. pipeline leaked for 1,472 days (see assumptions in Question 6). Approximately 13% of the daily discharge (9,000 gal) could have reached the soil, for a total of approximately 1,722,240 gal or 230,230 ft^3 of warm wastewater potentially released to the soil (see Question 6).

Block 2 How reliable are the information sources? ☐ High ☐ Med ☒ Low (check one) Explain the reasoning behind this evaluation.

While there is extensive information documenting that a release of warm wastewater from the 4-in. pipeline occurred, no information is available that states when the 4-in. warm waste pipeline was broken or how much wastewater was released as a result of the break. Therefore, without obtaining additional data, it is impossible to estimate the pattern of potential contamination.

Block 3 Has this information been confirmed? ☒ Yes ☐ No (check one) If so, describe the confirmation.

Several sources give information regarding the 4-in. warm waste pipeline. In addition, interviews with personnel intimately familiar with the 30-in. TRA-605 Warm Waste Pipeline Replacement Project were conducted. No information that documents the timeframe of the release or the quantity of the released wastewater is available.

Block 4 Sources of Information [check appropriate box(es) & source number from reference list]

No available information	☐	**Analytical data**	☒ 4,5,16,17,18,19,20,21
Anecdotal	☒ 2,11,13,14	**Documentation about data**	☐
Historical process data	☐	**Disposal data**	☐
Current process data	☐	**QA data**	☐
Areal Photographs	☐	**Safety analysis report**	☐
Engineering/site drawings	☒ 6,7,8	**D&D report**	☐
Unusual Occurrence Report	☒ 1	**Initial assessment**	☒ 15
Summary documents	☐	**Well data**	☐
Facility SOPs	☐	**Construction data**	☐
OTHER	☐		

PROCESS: Contaminated Soil; Abandoned Pipeline

Question 6. Estimate the length, width, and depth of the contaminated region. What is the known or estimated volume of the source? If this is an estimated volume, explain carefully how the estimate was derived.

Block 1 Answer:

The estimated maximum volume of the pipe is 6.37 ft^3. The line is approximately 73 ft of 4-in. Duriron pipe between TRA-605 and the former location of the 30-in. warm waste pipeline. The maximum volume of the pipeline was estimated by $V = \pi r^2 L$, where:

Pi (π) = 3.14
r = radius of the pipe
L = length of the pipe.

The maximum volume of the pipe is 6.37 ft^3. Converting this to gallons, the volume of the pipe is estimated to be 47.65 gal. This is the maximum quantity of radiologically contaminated resin that could be contained within the 4-in. pipeline.

An estimate of the potential contamination for the warm wastewater release that occurred before October 16, 2001, is approximately 1,722,240 gal or 230,230 ft^3.

This is based on the following assumptions:

1. The timeframe that the 4-in pipeline may have been leaking is from October 1, 1997 (when inspections showed no detected contamination) through October 16, 2001, which constitutes 1,472 days.
2. An average of 9,000 gal of warm wastewater flowed through the 4-in. pipeline on a daily basis.
3. The ratio of the surface area of the crack to the cross-sectional area of the pipe was approximately 0.13.
4. Approximately 13% of the discharge through the pipe could potentially have been lost through the crack for a total of approximately 1,722,240 gal impacting the soil volume.

Block 2 How reliable are the information sources? ☐ High ☒ Med ☐ Low (check one) Explain the reasoning behind this evaluation.

While there is extensive documentation that a release of warm wastewater from the 4-in. pipeline occurred, no information is available that states when the 4-in. warm waste pipeline was broken or how much wastewater was released as a result of the break. Therefore, the above calculations were estimated by using available data and numerous assumptions.

Block 3 Has this INFORMATION been confirmed? ☒ Yes ☐ No (check one) If so, describe the confirmation.

Several sources give information regarding the 4-in. warm waste pipeline. In addition, interviews were conducted with personnel intimately familiar with the 30-in. TRA-605 Warm Waste Pipeline Replacement Project. No information that documents the quantity of the released wastewater is available. Therefore, available data were used for the estimation of the length, width, and depth of the contaminated region.

Block 4	Sources of Information [check appropriate box(es) & source number from reference list]			
No available information	☐		Analytical data	☐
Anecdotal	☒ 2,11,13,14		Documentation about data	☐
Historical process data	☐		Disposal data	☐
Current process data	☐		QA data	☐
Areal Photographs	☐		Safety analysis report	☐
Engineering/site drawings	☒ 6,7,8		D&D report	☐
Unusual Occurrence Report	☒ 1		Initial assessment	☒ 15
Summary documents	☐		Well data	☐
Facility SOPs	☐		Construction data	☐
OTHER	☐			

PROCESS: Contaminated Soil; Abandoned Pipeline

Question 7. What is the known or estimated quantity of hazardous substance/constituent at this source? If the quantity is an estimate, explain carefully how the estimate was derived.

Block 1 Answer:

The estimated maximum quantity of hazardous substances/constituents at this site is contained within the 4-in. warm waste pipeline and in the contaminated soil adjacent to the 4-in. pipeline. These quantities follow:

Resin was found within the 4-in. pipeline in October 2001. While it is unlikely that the entire 4-in. pipeline is completely filled with resin, no record of the quantity of resin within the pipeline is available. Therefore, the following calculations were completed based on a worst-case scenario.

The pipeline is approximately 73 ft of 4-in. Duriron pipe between TRA-605 and the former location of the 30-in. warm waste pipeline. The maximum volume of the pipeline was estimated by $V = \pi r^2 L$, where:

Pi (π) = 3.14
r = radius of the pipe
L = length of the pipe.

The maximum volume of the pipe is 6.37 ft^3. Converting this to gallons, the volume of the pipe is estimated to be 47.65 gal. This is the maximum quantity of radiologically contaminated resin that could be contained within the 4-in. pipeline.

The maximum mass of resin that could be contained in the pipe can be determined by multiplying the maximum volume of the resin (6.37 ft^3) by the density of the resin (1.13 g/cm^3). As a result, the total mass of resin is 2.04E+05 g or 204 kg. Therefore, if break in the 4-in. pipeline occurred, and the maximum mass of radiologically contaminated resin (2.04E+05 g) was released to the soil, the soil area that would potentially be impacted is 6.37 ft^3.

Block 1 Answer (continued):

Concentration of radionuclides in the resin (C_R):

Radionuclides in Resin (C_R)	Concentrations (Totals)
C_R of Cr-51	7,000 pCi/g × 2.04E+05 g = 1.43E+09 pCi Cr-51
C_R of Mn-54	89 pCi/g × 2.04E+05 g = 1.81E+07 pCi Mn-54
C_R of Co-57	390 pCi/g × 2.04E+05 g = 7.95E+07 pCi Co-57
C_R of Co-58	114 pCi/g × 2.04E+05 g = 2.32E+07 pCi Co-58
C_R of Co-60	1.03E+04 pCi/g × 2.04E+05 g = 2.10E+09 pCi Co-60
C_R of Nb-95	710 pCi/g × 2.04E+05 g = 1.45E+08 pCi Nb-95
C_R of Zr-95	450 pCi/g × 2.04E+05 g = 9.17E+07 pCi Zr-95
C_R of Ce-141	14.5 pCi/g × 2.04E+05 g = 2.96E+06 pCi Ce-141
C_R of Ce-144	190 pCi/g × 2.04E+05 g = 3.87E+07 pCi Ce-144
C_R of Cs-134	77 pCi/g × 2.04E+05 g = 1.57E+07 pCi Cs-134
C_R of Cs-137	660 pCi/g × 2.04E+05 g = 1.35E+08 pCi Cs-137
C_R of Eu-152	520 pCi/g × 2.04E+05 g = 1.06E+08 pCi Eu-152
C_R of Eu-154	460 pCi/g × 2.04E+05 g = 9.38E+07 pCi Eu-154
C_R of Eu-155	156 pCi/g × 2.04E+05 g = 3.18E+07 pCi Eu-155
C_R of Hf-181	800 pCi/g × 2.04E+05 g = 1.63E+08 pCi Hf-181
C_R of Fe-59	19.5 pCi/g × 2.04E+05 g = 3.97E+06 pCi Fe-59
C_R of Zn-65	370 pCi/g × 2.04E+05 g = 7.54E+07 pCi Zn-65
C_R of Ru-103	54 pCi/g × 2.04E+05 g = 1.10E+07 pCi Ru-108
C_R of Ru/Rh-106	218 pCi/g × 2.04E+05 g = 4.44E+07 pCi Ru/Rh-106
C_R of Ta-182	77 pCi/g × 2.04E+05 g = 1.57E+07 pCi Ta-182

Potential volume of wastewater impacting soil = 1,722,240 gal or 230,230 ft^3

Potential volume of impacted soil = 230,230 ft^3/.05 = 4.60E+06 ft^3 of soil (based on information in Appendix B)

Soil density = 1.855 g/cm^3

Potential mass of contaminated soil

(1.855 g/cm^3) × (1.303878E+11 cm^3) × (1 kg/1E03 g) = 2.42E+8 kg soil

2.42E+11 g is the maximum quantity of radiologically contaminated soil that could be impacted at TRA-63. Since fifteen 55-gal drums of contaminated soil were removed from the site, and each of these drums weighed approximately 787 lb, approximately 5.35E+06 g of contaminated soil was removed from the site. Therefore, this still may leave approximately 2.42E+11 g of contaminated soil at TRA-63.

Block 1 Answer (continued):

Concentration of radionuclides in the contaminated soil (C_s)[22,23]:

Radionuclides in Contaminated Soil (C_s)	Concentration
C_s of Na-24	0.7 pCi/g × 2.42E+11 g = 1.69E+11 pCi Na-24
C_s of Cr-51	450 pCi/g × 2.42E+11 g = 1.09E+14 pCi Cr-51
C_s of Mn-54	36 pCi/g × 2.42E+11 g = 8.71E+12 pCi Mn-54
C_s of Co-57	390 pCi/g × 2.42E+11 g = 9.43E+13 pCi Co-57
C_s of Co-58	26 pCi/g × 2.42E+11 g = 6.29E+12 pCi Co-58
C_s of Co-60	4.6E+3 pCi/g × 2.42E+11 g = 1.11E+15 pCi Co-60
C_s of Nb-95	84 pCi/g × 2.42E+11 g = 2.03E+13 pCi Nb-95
C_s of Zr-95	41 pCi/g × 2.42E+11 g = 9.92E+12 pCi Zr-95
C_s of Ce-141	14.5 pCi/g × 2.42E+11 g = 3.51E+12 pCi Ce-141
C_s of Ce-144	28 pCi/g × 2.42E+11 g = 6.77E+12 pCi Ce-144
C_s of Cs-134	39 pCi/g × 2.42E+11 g = 9.43E+12 pCi Cs-134
C_s of Cs-137	550 pCi/g × 2.42E+11 g = 1.33E+14 pCi Cs-137
C_s of Eu-152	340 pCi/g × 2.42E+11 g = 8.22E+13 pCi Eu-152
C_s of Eu-154	370 pCi/g × 2.42E+11 g = 8.95E+13 pCi Eu-154
C_s of Eu-155	117 pCi/g × 2.42E+11 g = 2.83E+13 pCi Eu-155
C_s of Gross Alpha	4.9 pCi/g × 2.42E+11 g = 1.19E+12 pCi Gross Alpha
C_s of Gross Beta	1,830 pCi/g × 2.42E+11 g = 4.43E+14 pCi Gross Beta
C_s of Hf-181	88 pCi/g × 2.42E+11 g = 2.13E+13 pCi Hf-181
C_s of Fe-59	19.5 pCi/g × 2.42E+11 g = 4.72E+12 pCi Fe-59
C_s of Zn-65	168 pCi/g × 2.42E+11 g = 4.06E+13 pCi Zn-65
C_s of Ru-103	3.7 pCi/g × 2.42E+11 g = 8.95E+11 pCi Ru-108
C_s of Ru/Rh-106	218 pCi/g × 2.42E+11 g = 5.27E+13 pCi Ru/Rh-106
C_s of Ta-182	17 pCi/g × 2.42E+11 g = 4.11E+12 pCi Ta-182

Block 1 Answer (continued):

1,722,240 gal, 230,230 ft^3, or 6.519E+09 mL is the maximum quantity of radiologically contaminated wastewater that could impact the soil at TRA-63.

Concentration of radionuclides in the wastewater (C_w)[22–24]:

Radionuclides in Wastewater (C_w)	Concentration
C_w of H-3	9.35E+03 pCi/mL × 6.519E+09 mL = 6.21E+13 pCi
C_w of Na-24	3 pCi/mL × 6.519E+09 mL = 1.96E+10 pCi
C_w of Cr-51	57 pCi/mL × 6.519E+09 mL = 3.72E+11 pCi
C_w of Mn-54	1 pCi/mL × 6.519E+09 mL = 6.52E+09 pCi
C_w of Co-60	192 pCi/mL × 6.519E+09 mL = 1.25E+12 pCi
C_w of Nb-95	9.1 pCi/mL × 6.519E+09 mL = 5.93E+10 pCi
C_w of Zr-95	5.9 pCi/mL × 6.519E+09 mL = 3.85E+10 pCi
C_w of Mo-99	0.5 pCi/mL × 6.519E+09 mL = 3.26E+09 pCi
C_w of Sb-124	0.61 pCi/mL × 6.519E+09 mL = 3.98E+09 pCi
C_w of Cs-137	10.3 pCi/mL × 6.519E+09 mL = 6.71E+10 pCi
C_w of Eu-152	29 pCi/mL × 6.519E+09 mL = 1.89E+11 pCi
C_w of Eu-154	29 pCi/mL × 6.519E+09 mL = 1.89E+11 pCi
C_w of Eu-155	10.8 pCi/mL × 6.519E+09 mL = 7.04E+10 pCi
C_w of Gross Alpha	0.8 pCi/mL × 6.519E+09 mL = 5.23E+09 pCi
C_w of Gross Beta	280 pCi/mL × 6.519E+09 mL = 1.83E+12 pCi
C_w of Hf-181	7 pCi/mL × 6.519E+09 mL = 4.56E+10 pCi

Block 2 How reliable are the information sources? ☐ High ☒ Med ☐ Low (check one)
Explain the reasoning behind this evaluation.

While there is extensive documentation that a release of warm wastewater from the 4-in. pipeline occurred, no information is available that states when the 4-in. warm waste pipeline was broken or how much wastewater was released as a result of the break. Therefore, the above calculations were estimated by using available data and numerous assumptions. The assumptions made were based on the worst case in all situations.

Block 3 Has this INFORMATION been confirmed? ☒ Yes ☐ No (check one)
If so, describe the confirmation.

Several sources provide information regarding the 4-in. warm waste pipeline. In addition, interviews were conducted with personnel intimately familiar with the 30-in. TRA-605 Warm Waste Pipeline Replacement Project. No documentation about the quantity of the released wastewater is available. Therefore, available data were used to determine the estimated quantity of hazardous constituents at this source.

Block 4	Sources of Information [check appropriate box(es) & source number from reference list]			
No available information	☐		Analytical data	☒ 4,5,16,17,18,19,20,21
Anecdotal	☒ 2,11,13,14		Documentation about data	☐
Historical process data	☐		Disposal data	☐
Current process data	☐		QA data	☐
Areal Photographs	☐		Safety analysis report	☐
Engineering/site drawings	☒ 6,7,8		D&D report	☐
Unusual Occurrence Report	☒ 1		Initial assessment	☒ 15
Summary documents	☐		Well data	☐
Facility SOPs	☐		Construction data	☐
OTHER	☐			

PROCESS: Contaminated Soil; Abandoned Pipeline

Question 8. Is there evidence that this hazardous substance/constituent is present at the source as it exists today? If so, describe the evidence.

Block 1 Answer:

Yes, there is evidence that the hazardous substance/constituent is present at the source as it exists today. The former 4-in. warm waste pipeline, which is still located beneath the ground surface at this site, contains an undetermined quantity of resin contaminated with warm waste. The line is capped at both ends, and the pipeline is in good condition. Therefore, the source is the remaining pipe, which is capped and abandoned in place.

Block 2 How reliable are the information sources? ☒ High ☐ Med ☐ Low (check one) Explain the reasoning behind this evaluation.

The information regarding the source at TRA-63 is well documented and is considered highly reliable. An engineering drawing documents the presence and location of the 4-in. warm waste pipeline (Appendix D, Reference 6). The NSI describes the 4-in. pipeline and establishes that a release of warm wastewater occurred. In addition, the occurrence report confirms the information given in the NSI. Furthermore, interviews with personnel intimately familiar with the 30-in. TRA-605 Warm Waste Pipeline Replacement Project confirm that the 4-in. pipeline is still located below the ground surface at TRA-63.

Block 3 Has this INFORMATION been confirmed? ☒ Yes ☐ No (check one) If so, describe the confirmation.

Several sources provide information regarding the 4-in. warm waste pipeline. In addition, the information regarding the source at TRA-63 is well documented and is therefore considered highly reliable.

Block 4 Sources of Information [check appropriate box(es) & source number from reference list]

No available information	☐	**Analytical data**	☐
Anecdotal	☒ 2,11,13,14	**Documentation about data**	☐
Historical process data	☐	**Disposal data**	☐
Current process data	☐	**QA data**	☐
Areal Photographs	☐	**Safety analysis report**	☐
Engineering/site drawings	☒ 6,7,8	**D&D report**	☐
Unusual Occurrence Report	☒ 1	**Initial assessment**	☒ 15
Summary documents	☐	**Well data**	☐
Facility SOPs	☐	**Construction data**	☐
OTHER	☐		

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